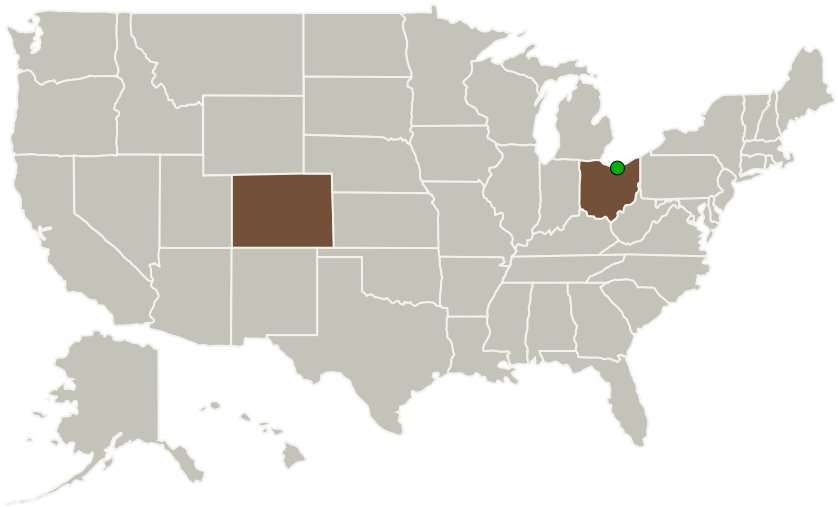
Ultra High Energy Solid-State Batteries for Next Generation Space Power, Phase I

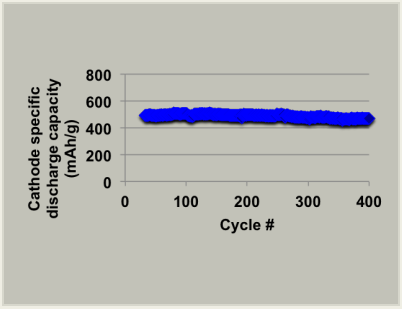
Completed Technology Project (2014 - 2014)

Project Introduction

The use of lithium (Li) metal as an anode material has emerged as one highly attractive option for achieving high specific energy due to lithium having the highest capacity (3876 mAh g-1) of all potential anode materials. However, the reliable use of these exceptionally high capacity anodes in a commercial cell has not been achieved due to safety and reliability concerns resulting from thermal runaway and short-circuit issues due to dendritic growth on the metal anode from lithium plating during charge-discharge cycles. Solid-state electrolytes (SSE) have been identified as one option to address this cell failure mode, but SSE technologies must be developed that combine high conductivity and mechanical properties conducive to smooth Li plating with feasible manufacturing processes. Also, the Li anode must be combined with an ultra-high capacity cathode in order to reach NASA's aggressive cell-level energy goals. To address this need, Solid Power proposes to utilize a Li-metal-compatible solid-state battery design to far exceed the specific energies achieved by state-of-the-art (SOTA) Li-ion batteries in a format that also provides for intrinsic safety and abuse tolerance. Phase I will demonstrate the feasibility of surpassing 600 Wh/kg and 1000 Wh/L at the cell level which will give a 3-5X improvement over the best battery technologies planned for NASA missions today.

Primary U.S. Work Locations and Key Partners





Ultra High Energy Solid-State Batteries for Next Generation Space Power Project Image

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Organizations Performing Work	Role	Type	Location
Solid Power, Inc.	Lead Organization	Industry	Louisville, Colorado
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Colorado	Ohio

Project Transitions

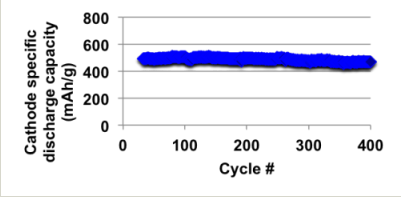
June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137349)*

Images



Project Image
Ultra High Energy Solid-State Batteries for Next Generation Space Power Project Image *(https://techport.nasa.gov/image/127697)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Solid Power, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Joshua Buettner-garrett

Co-Investigator:
Joshua Buettner-garrett

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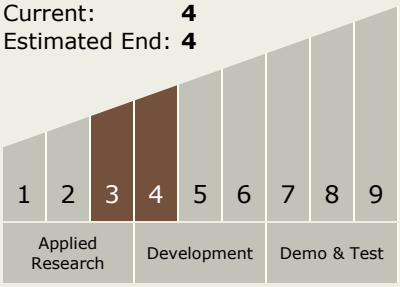
Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.2 Energy Storage
    - TX03.2.1 Electrochemical: Batteries

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System